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Economic Efficiency and Solving Environmental Problems in the Republic of Uzbekistan in the Mining of Minerals

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Annotation. The article is devoted to reducing the cost of mining and finished products from them, as well as solving environmental problems when using industrial waste to fill the goaf formed during underground mining

The practice of using industrial waste is relevant in the modern world, as it allows to provide a rich source of cheap and often already prepared raw materials, leads to savings in capital investments in the construction of enterprises that extract and process natural raw materials, frees up significant areas of land occupied by dumps and significantly reduces the degree of environmental pollution. the environment due to the elimination of waste dumps.

The volume of industrial waste is increasing at a higher rate than social production, as they tend to outpace growth. The cost of removing and storing waste in dumps is on average 10-12% of the cost of the main products.

The scale of the use of industrial waste in the production of building materials in the CIS, as well as in other developed countries of the world, is steadily increasing. Thus, the total use of blast-furnace slags is about 90%. The national economic efficiency of processing and use of each million tons of blast-furnace slag in Russia is 25-30 million rubles[2].

However, the overall level of utilization of industrial wastes - fuel and energy, mining, woodworking, chemical and others is still insufficient. In the CIS, only about 15% of the volume of ash and slag waste from the energy industry is used, and slag from non-ferrous metallurgy is not more than 5%.

The mining industry of the Republic of Uzbekistan has been given a task until 2020. to double the extraction of ore, including gold-bearing. When the ore is mined underground, there is a problem with filling the mined-out space. The filling technology currently used is to prepare filling mixtures (Portland cement, inert aggregates and water) on the surface with a further supply of this mixture through the pipeline to the laying sites [1].

Our research is devoted to the issue of using waste from the mining industry (waste from a marble quarry), energy (fly ash from thermal power plants), chemical (granular electro ferrophosphorus slag and soda-sulfate mixture - waste from the production of caprolactam) in the preparation of backfill mixtures used to backfill the worked-out space formed during underground mining works.

At the “ Kauldy ” mine of the Almalyk “ Mining and Metallurgical Plant”, a classic backfill mixture was used, consisting of Portland cement (250-300 kg / m ^{3}), mountain sand and water. Our research allowed us to replace 20-25% of Portland cement with fly ash and 100% of mountain sand with waste from a marble quarry located near the mine.

Using the mathematical method of planning experiments, we have developed the optimal compositions of two types of filling mixtures, one of them received a patent of the Republic of Uzbekistan [3]:

- backfill mixture based on slag-alkaline binder using electro thermophosphor slag, soda-sulfate mixture and marble quarry waste;
- backfill mixture on cement-ash binder using marble quarry waste and fly ash.

The optimal compositions of the developed filling mixtures are shown in tables 1 and 2.

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Table 1.
Optimal compositions of filling mixtures using fly ash and marble quarry waste

Consumption, materials per 1 m ^{3} filling mixture					Cone draft, cm	The density of the filling mixture, kg / m ^{3}	Average compressive strength, MPa
Portland cement brand 400, kg	Fly ash, kg	Marble quarry waste, kg	Mountain sand, kg	Water, l			
one hundred	350	870	-	380	11.5	1760	2.6
150	300	830	-	375	11.2	1800	4.4
200	300	750	-	370	11.4	1820	4.9
one hundred	-	1300	-	380	12.0	1710	1.7
150	-	1250	-	380	11.7	1750	2.2
200	-	1200	-	375	11-12	1780	3.7
250	-	1150	-	375	11-12	1800	5.2
200	-	-	1200	380	11-12	1780	2.3

Table 2.
Optimal compositions of backfill mixtures based on slag-alkali binder

Consumption, materials per 1 m ^{3} filling mixture					Cone draft, cm	The density of the filling mixture, kg / m ^{3}	Average compressive strength, MPa
Ground granulated slag, kg	Marble quarry waste, kg	mountain sand, kg	Consumption of alkaline component, kg	The density of the alkaline solution g/cm ^{3}			
150	1290	-	nine	1300	11.3	1650	6.8
200	1250	-	12	1300	11.8	1700	9.5
150	-	1240	nine	1300	11.4	1650	4.7
200	-	1300	12	1300	11.8	1690	8.9

Analyzing the data of these tables, we can conclude that, in terms of their physical, mechanical and rheological characteristics, they fully comply with the requirements of the technical conditions for the Kauldy mine.

Based on the results of the practical use (from 2000 to 2015) of backfill mixtures based on fly ash and marble quarry waste at the Kauldy mine of the Almalyk Mining and Metallurgical Combine OJSC, the economic efficiency was calculated by the specialists of this mine. The calculation showed that when using 36 thousand m ^{3} of filling mixtures per year with the use of industrial waste and reducing transport costs, the economic effect is about 600 million sums. At the same time, it should be taken into account that the annual demand of the mine for stowing mixtures is 55-60 thousand tons. m ^{3}, i.e. With the complete replacement of natural materials with industrial waste, it is possible to save more than one billion sums per year, only at one mine for the extraction of minerals.

It should also be noted an important aspect of solving the environmental problem arising from the release of dumps from the storage of fly ash and marble quarry waste. This makes it possible to free up land, reduce transportation costs for the delivery of waste to dumps and their storage, as well as reduce the emission of dust particles of waste into the atmosphere.

Literature

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